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ABSTRACT

Arizona's medical laboratory personnel training programs were examined in relation to the nationwide development and distribution of laboratory personnel classifications (Medical Technologist--MT, Medical Laboratory Technician--MLT, and Certified Laboratory Assistant--CLA) and the national educational response which has resulted in an increase in the number of programs and program graduates and a standardization of curricula and expected competencies. Three state universities and four community colleges formally offer some level of training. Arizona Western College, Pima Community College, and Yavapai College offer only two-year transfer programs, approximately equivalent to the first two years at one of the university MT programs offered at Arizona State University, Northern Arizona University, and the University of Arizona. Phoenix College offers the two-year transfer program in addition to formal CLA and MLT training programs. Curricula data for all programs indicated that transfer programs required approximately the same courses as four-year programs, although lacking half of the humanities, social sciences, and mathematics requirements; at this level, there were no internships. The specifically accredited CLA and MLT programs required internships for completion. MT programs were broader and more in-depth. Enrollment data, plans for expansion and a bibliography are included. (TR)

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MEDICAL LABORATORY TECHNICIAN AND TECHNOLOGIST TRAINING: ARIZONA HEEDS THE CALL

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INTRODUCTION

A medical laboratory can be an exciting and fascinating place to work. It can be scientifically and academically stimulating while at the same time offering humanistic outlets. The concern for humanity is innate, whereas the abilities to deal with the scientific responsibilities of the laboratory are not. Consequently, these positions require specialized training. Let us then examine the various laboratory positions available, the training they require, and the status of these training programs in Arizona.

LABORATORY PERSONNEL

Classification

In 1973 the American Society for Medical Technology (ASMT), a major professional organization of all medical laboratory personnel, identified and elucidated three categories of medical laboratory practitioners.[9] These are the Medical Technologists (MT), Medical Laboratory Technicians (MLT), and the Certified Laboratory Assistants (CLA). These were determined after examining six broad types of laboratory activity: performing analyses, solving problems, systems control, organization and communication, supervision and management, teaching, and continuing education. Professional attitudes, patient relations, and personal integrity were naturally a prerequisite for all laboratory personnel.

The CLA should, at career entry, be able to correctly perform the most routine, uncomplicated procedures using common instrumentation. He is responsible for his own work but is expected to obtain assistance for any out-of-the-ordinary problem.

The MLT is expected to have the capabilities of the CLA, but is in addition expected to perform and evaluate all of the routine tests including those using sophisticated instruments. Thus, a broader knowledge of test procedures and instruments is required as is the ability to monitor a quality control program in anticipation of unexpected errors. Simple corrections for which predetermined procedures are available are expected to be made by the MLT. He again is responsible for his own work and capable of having one or two people to supervise.

The MT, however, is expected to perform complex procedures which require fine-line decisions. An in-depth knowledge of the techniques, principles, instruments, and their inter-relationships is necessary as is an in-depth knowledge of the physiological conditions which may affect the test results. The MT's test procedures often have no references for confirmation which necessitates a certain resourcefulness and requires the MT to be accountable for his/her test result accuracy. Moreover, the MT is expected to recognize and solve problems on all levels using foresight and proper judgement as well as be responsible for all work done in his area of supervision.

Career entry competency for all three levels of laboratory personnel is determined by successful completion of a defined, structured program for that level (or demonstration of equivalent competency) and passage of a national registry examination.

Development and Distribution

There were 170,487 persons registered as certified laboratory practitioners through 1977. Of those, 118,588 were MTs, 12,112 were MLTs, and 17,602 were CLAs.[16] The rest are various specialists not to be discussed at this time.

The tenfold discrepancy between the MTs and CLAs and MLTs is a consequence of the history of laboratory development. The first surge was in the early part of the 20th century when the United States became involved in two World Wars. One consequence of those wars was an increased need for medical facilities and especially diagnostic laboratory techniques and personnel. Consequently, laboratory and other medical personnel joined together to initiate some standardization of measuring competency among prospective laboratory personnel. The result was the national registry examination for medical technologists. Educational requirements were more lax, and anyone who worked in a laboratory became known as a "lab tech".

In the early 1960's the Social Security Administration gave birth to the Medicare and Medicaid programs to extend

health care to millions who could not otherwise afford that care. Realizing the impact this would have on existing medical facilities and personnel, in 1965 the federal government made funds available to numerous institutions for training programs in various allied health fields. In 1967 the Clinical Laboratories Improvement Act was passed in an attempt to improve and guarantee proficiency in all aspects of all laboratories serving Medicare patients. In 1968 the ASMT and the ASCP (American Society of Clinical Pathologists) began requiring completion of a baccalaureate degree before registration and national certification as a Medical Technologist. Coincidentally it was recognized that not all of the work performed in a laboratory requires a bachelor's degree, but does require some training. Thus, the birth of the CLA and MLT as formally and uniformly recognized laboratory positions. The consequent competency requirements and examinations for the CLA and MLT were not long to follow.

A recent survey by the Laboratory Management Consultation Office of the Center for Disease Control[17] estimated that 200,009 full-time and part-time technical personnel were employed in U. S. laboratories in 1976. This was a 54% increase from their 1971 survey when only 129,847 were employed. Of the estimated 167,974 full-time technical personnel (supervisory and nonsupervisory), 70% had at least an associate degree. More specifically, 18,124 had an associate degree (a 145% increase since 1971), 82,045 had a

bachelor's degree (an 85.2% increase), and the majority of the remaining personnel had at least a master's degree. Of the 123,748 full-time nonsupervisory personnel in 1976, 15,157 had an associate degree (a 175.9% increase since 1971), and 59,877 had a bachelor's degree (a 90.9% increase). The majority of the remaining nonsupervisory personnel had no academic degree (a 68.6 increase since 1971).

NATIONAL EDUCATIONAL RESPONSE

Rate of Increase

It is obvious that the predicted growth of laboratory staffs is a reality. The growth in graduates of MLT and CLA training programs is also a reality. Table I[3, 4, 5] summarizes the number of associate degrees and other formal recognitions given upon completion of such programs. Those awarded toward a baccalaureate would represent persons with college transfer credit courses for immediate progression to a 4-year college or university MT program. This group increased 233% in the four years studied. Those recognized in programs not toward a baccalaureate degree are MLTs without specific college transfer courses. This group increased 261%. The CLAs in programs of less than two years showed no such tendencies. Each category maintained a relatively constant male to female ratio.

Standard Curricula

Graduates in all accredited training programs are expected to have similar competencies. For example, the CLA trainees

Table I

AWARDS GRANTED TO MEDICAL/BIOLOGICAL LABORATORY ASSISTANTS

TOWARD A BACCALAUREATE DEGREE

		MEN		WOMEN	
Year	Total	Total	%	Total	%
1971-72	836	232	27.8	604	72.2
1972-73	1217	307	25.2	910	74.8
1973-74	1551	461	29.7	1090	70.3
1974-75	1946	554	28.5	1392	71.5

NOT TOWARD A BACCALAUREATE DEGREE

		MEN		WOMEN	
Year	Total	Total	%	Total	%
1971-72	495	97	19.6	398	80.4
1972-73	685	121	17.7	564	82.4
1973-74	1066	197	18.5	869	81.5
1974-75	1292	241	18.7	1051	81.3

PROGRAMS OF LESS THAN TWO YEARS

		MEN		WOMEN	
Year	Total	Total	%	Total	%
1971-72	499	43	8.6	456	91.4
1972-73	345	30	8.7	315	91.3
1973-74	462	68	14.7	394	85.3
1974-75	389	26	6.7	363	93.3

CUMULATIVE DATA

Year	Total	4-year	2-year	1+-year	Men	Women
1971-72	1830	45.7%	27.0%	27.3%	20.3%	79.7%
1972-73	2247	54.2%	30.5%	15.3%	20.4%	79.6%
1973-74	3079	50.4%	34.6%	15.0%	24.6%	76.4%
1974-75	3627	53.7%	35.6%	10.7%	22.6%	77.4%

are expected[11] to have been oriented in:

(a) professional adjustments
(b) medical ethics
(c) medical terminology
(d) laboratory records
(e) basic anatomy and physiology
(f) laboratory equipment
(g) asceptic technique and sterilization methods
(h) basic laboratory mathematics
(i) solution and media preparation
(j) basic quality control
(k) hisologic and cytologic specimens
(l) blood collecting techniques
(m) basic blood banking, hematology, serology, and urinalysis

Their programs are to be at least twelve months in length, including a 100 hour minimum of didactic instruction which stresses technical performance and detection of errors.

The MLT program is a two-year associate degree program which involves a more in-depth study of the above topics. Institutional general education requirements are also required.

The MT program is a multidisciplinary baccalaureate program.[14] In addition to university-required humanities, social sciences, and physical education requirements, the medical technology major is expected to have general biology, anatomy and physiology, biochemistry, and microbiology. These are to be supported by courses in general chemistry, organic chemistry, analytical chemistry, physics, and mathematics to at least the algebra and trigonometry level. In addition, a one-year internship is required where practical laboratory experience is obtained and such subjects as medical microbioloby, medical parasitology, clinical chemistry,

clinical hematology, immunohematology, immunolgy and serology, and urine and body fluid analysis are covered by each intern.

Upon satisfactory completion of these programs, application to take the appropriate registry examination is made. Passage of all areas of the examination entitles the applicant to national registration.

ARIZONA TRAINING PROGRAMS

Institutions

A survey of the educational institutions of Arizona shows that three state universities and four community colleges formally offer some level of medical laboratory personnel training. Arizona Western College (AWC) in Yuma,[2] Pima Community College (PCC) in Tucson,[22] and Yavapai College (YAV) in Prescott,[30] offer only two-year transfer programs which are approximately equivalent to the first two years at one of the three state university MT programs. These medical technology programs are located at Arizona State University (ASU) in Tempe,[1] Northern Arizona University (NAU) in Flagstaff,[19] and the University of Arizona (UA) in Tucson.[28] One other community college, Phoenix College (PHX) in Phoenix[21] offers not only the two-year transfer program, but also a formal CLA and MLT training program.

Curriculum

The curriculum recommended by each institution for its students is summarized in Table II. It can be seen that the

Table II

	ASU MT	NAU MT	UA MT	PHX CLA	PHX MLT	PHX MT	AWC MT	PCC MT	YAV MT
English Composition	6	6	6	6	6	6	6	6	6
Introductory Chemistry	8	8	8	4	4	8	8	8	10
Math (Algebra, Trig.)	12	4	5	-	-	6	5	6	5
Intro. to Health Field	-	-	3	-	-	-	-	-	-
Social Sciences	12	13	12	-	6	6	6	9	6
Physical Education	-	2	2	-	-	2	2	-	2
Introductory Microbiology	6	4	4	1	1	4	4	8	-
Humanities	12	12	4-6	2	2	8	6	8	8
Anatomy and Physiology	4	-	8	2	2	-	8	8	-
Orientation to Medical Lab.	1	-	2	1	1	-	-	-	-
Organic Chemistry	8	3	8	-	-	-	5	8	8
Physics	6	3	8	-	-	4	-	-	-
Biological Sciences Math	-	-	3	2	2	-	-	3	-
Computing	-	-	3	-	-	-	-	3	-
Intro. to Medicine	-	-	3	-	-	-	-	-	-
Immunology	4	4	4	-	-	-	-	-	-
Parasitology	4	-	4	2	2	-	-	-	-
Analytical Chemistry	5	2	3	-	3	8	4	-	-
Clinical or Biochemistry	3	4	3	-	-	-	-	-	-
Social Perspectives of H. Sci.	-	-	3	-	-	-	-	-	-
Problems in Med. Tech.	-	-	3	-	-	-	-	-	-
Pathogenic Microbiology	3	4	4	-	4	-	-	-	-
General Pathology	-	-	4	-	-	-	-	-	-
Mycology	3	-	4	-	2	-	-	-	-
Zoology	-	-	-	-	-	-	-	-	4
Botony	-	-	-	-	-	-	-	-	4
General Biology	8	8	-	-	3	4	-	-	8
Genetics	3	4	-	-	-	4	-	-	-
Internship-Practicum	32	30	30	6	6	-	-	-	-
Hematology	"	"	"	4	8				
Clinical Chemistry	"	"	"	5	10				
Routine Analysis	"		"	-	3				
Immunohematology	"	"	"	4	6				

transfer programs (PHX MT, AWC MT, PCC MT, and YAV MT) require approximately the same courses, but that these are only half of the humanities, social sciences, and mathematics as the complete four-year programs (ASU MT, NAU MT, AND UA MT). There is no internship at this level. The CLA and MLT programs, however, are specifically accredited programs which do require an internship for completion. Their curriculums reflect a feeder system arrangement where the CLA can progress into the MLT degree requirements. The MT programs are, of course, broader and more in-depth. Their internship is a 12-month program, usually a combination of on-campus and in-hospital training for which they receive 30-32 units of credit toward a bachelor's degree. All the programs have a curriculum which is in accord with the national recommendations.

Enrollment

Official enrollment figures for the transfer programs have been impossible to obtain since medical technology transfer students are not distinguished from any other transfer student.[12, 23, 25] The numbers appear minimal, however. Arizona Western College reports none in the last three years,[23] whereas Pima Community College reports that six persons a year express interest.[12]

A similar situation seems to exixt at Phoenix College where 16 students graduated from the MLT program in 1978 while an undetermined (perhaps nonexistent) group stopped at the CLA level.[20] There have been 20 MLT internships

available each year since the program's initiation in 1974.

The present University of Arizona MT program is also in its formative years. The first class in 1976-77 filled 16 of its 18 positions. Last year's class graduated 15 and had 5 positions unfilled. The upcoming 1978-79 class has a prospective 14 students for 22 positions.[28] The longer established programs at ASU and NAU graduate 25-30[8] and 20[7] students each year respectively. They also report that the male population of their classes has increased from 1% to 33% in the last decade.

Plans for Expansion

Three plans for expanding the availability of laboratory training programs in Arizona were discovered consequent to the enrollment survey presented above. The first was a 1975 attempt by Yavapai College to obtain a grant from the Bureau of Indian Affairs to establish an MLT program for students from the Hualapai Indian Reservation in Northern Arizona. This did not materialize, however, when the grant was denied at the last moment.[12]

Another MLT program has been drawn up at Pima Community college.[25] The program, which was initially estimated to open in the fall of 1978, is currently awaiting the Board of Governors' final action providing specific laboratory space for the program. It is conceivable that present facilities could be reorganized and allotted for that training allowing a fall 1979 opening. If new facilities are deemed necessary,

1980 seems a more likely target date. No CLA program is anticipated.

The final expansion plan is in the University of Arizona MT program. The program which started in August 1976 with 18 openings projects an increase of two positions per year until 1982 when 30 internships are available. No further inflation is foreseen thereafter.

CONCLUSIONS AND SUMMARY

It has been seen that laboratory staffs across the United States have expanded in this decade. Graduates of appropriate training programs have correspondingly increased. Arizona reflects this nationwide trend in expanding the educational opportunities for prospective laboratory personnel, concentrating on the new classifications of MLT and CLA. Community professional advisory committees have indicated the need for these trained personnel and the community colleges of the larger metropolitan areas have tried to respond. The committees have also indicated that once the proposed expansions previously mentioned are completed, the community's needs will be satisfied. Any further expansion at this point seems extravagant and would result in a flooded job market for all three classifications as the newly trained, and less expensive, MLTs would be hired for some positions now held by MTs.[25] Therefore, any prospective CLA, MLT, or MT in Arizona can (or will soon be able to) find the appropriate training program in Phoenix or Tucson and be relatively assured of employment thereafter.

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